

# From Information to Cognition: The Systems Counterculture, Heinz von Foerster's Pedagogy, and Second-Order Cybernetics

Bruce Clarke • Texas Tech University • brunoclarke/at/gmail.com

**> Context** • In this empirical and conceptual paper on the historical, philosophical, and epistemological backgrounds of second-order cybernetics, the emergence of a significant pedagogical component to Heinz von Foerster's work during the last years of the Biological Computer Laboratory is placed against the backdrop of social and intellectual movements on the American landscape. **> Problem** • Previous discussion in this regard has focused largely on the student radicalism of the later 1960s. A wider-angled view of the American intellectual counterculture is needed. However, this historical nexus is complicated and more often dismissed than brought into clear focus. **> Method** • This essay assembles a historical sequence of archival materials for critical analysis, linked to a conceptual argument eliciting from those materials the second-order cybernetic concepts of observation, recursion, and paradox. **> Results** • In this period, von Foerster found the "positive of the negative" in the social and intellectual unrest of that moment and cultivated those insights for the broader constitution of a new cognitive orientation. **> Implications** • As a successful student of his own continuing course on heuristics, von Foerster left the academic mainstream to ally his constructivist epistemology with the systems counterculture. **> Key words** • Heinz von Foerster, American counterculture, Biological Computer Laboratory, heuristics, pedagogy, cognition.

## Introduction

In the first decade of the Biological Computer Laboratory (BCL), its director, Heinz von Foerster, taught few organized classes. His career in the university classroom begins in earnest in the fall of 1968 with a three-semester sequence titled "Heuristics," and continues until the BCL closes in the spring of 1974, at the conclusion of the two-semester sequence "Cybernetics of Cybernetics." In recent years, a number of accounts have been published discussing these unprecedented and certainly unduplicated team-taught, student-driven, interdisciplinary, and cross-level courses (Umpleby 2007; Martin 2007; Hutchinson 2008; Foerster & Broecker 2010; Scott 2011). This paper will explore lines of relation between the sudden emergence of a sustained university-pedagogical component to the work of the BCL and two other concurrent trends: the growing importance of cybernetics and systems theory within the intellectual wing of the American counterculture, as documented by the *Whole Earth*

*Catalog*, and von Foerster's turn from an earlier theoretical base in information theory toward the cognitive and observer-centered orientations that came to be called second-order cybernetics. That all of these movements coincide at the end of the 1960s is not coincidental. Rather, they epitomize a larger trend in that era connecting cybernetic concepts to alternative philosophies and lifestyles as well as to a range of postmodern scientific formations.

A recent article in *Kybernetes* discusses the origins and workings of the Heuristics courses. It locates their prime driver in the ferment of late-1960s campus protests aligned with the anti-Vietnam War movement:

"During the Fall of 1968, von Foerster and Herbert Brün offered an experimental interdisciplinary course that fed off the energy of the campus uprisings that were taking place in the USA. Their experimental heuristics course marked a departure for the Biological Computer Laboratory (BCL) into the realm of pedagogy... The course

was an attempt at radically interdisciplinary inquiry in a period of social upheaval on campus." (Scott 2011: 1149-1150)

The campus ferment occurring at that precise moment is certainly a crucial part of the history at hand. However, the continuation and longevity of von Foerster's pedagogical initiatives prompt a further consideration. Even after the campus upheavals over the Vietnam War begin to recede in the early 1970s, von Foerster's courses go through three more iterations over another five years. In addition, all four of them yield a collectively-authored student-produced publication: the *Whole University Catalogue* in 1969, the *Ecological Source Book* in 1970, *Metagames* in 1972, and most famously, at 523 pages, *Cybernetics of Cybernetics* in 1974. To explain the persistence of these teaching projects as well as the varying tenors of their communal productions, we will need to look beyond the student radicalism of the later 1960s, as manifested at the University of Illinois, and take a wider-angled view of the

American intellectual counterculture as that also persisted beyond the late 1960s. Within that larger context, the courses coming out of the BCL may be seen to join von Foerster's laboratory to what I will call "the systems counterculture."

To be sure, the historical nexus I mean to cover with this phrase is vexed. It is risky to generalize about it. It is hard to bring into clear focus because it splinters into so many pieces. But in assessing the most significant and productive outcomes of the interplay between cybernetic discourses and practices and the intellectual legacies of the 1960s, it helps to keep at the center of one's attention von Foerster's unique professional position and cultural location. Not doing so hampers an otherwise important contribution to this discussion, Andrew Pickering's *The Cybernetic Brain: Sketches of another Future*. Pickering notes that "the sixties were the heyday of cybernetics, the period when this marginal and antidisciplinary field made its greatest inroads into general awareness," and that, as a result, his book "might have been the place for an extended examination of the counterculture." (Pickering 2010: 12) Instead, he writes a book with valuable historical and archival work about British cybernetics. But in its theoretical dimension, Pickering tries to reinvent the cybernetic wheel for "another future." Unfortunately, in that attempt he discards too much of its actual past. His substantial treatments of the British-born cyberneticists W. Ross Ashby, Gregory Bateson, Stafford Beer, and Gordon Pask marginalize second-order cybernetics by reducing von Foerster's major role as their colleague, collaborator, and frequent benefactor to not much more than a footnote.

In one footnote, Pickering mentions Beer's "acknowledgement of inspiration from Heinz von Foerster. Beer, Pask, and von Foerster were among the leading contributors to the development of a cybernetic theory of consciousness" (Pickering 2010: 457). Pickering goes on to give "two reasons for not going further into the cybernetic analysis of consciousness. One is that it seems to me largely theoretical, rather than connecting to novel domains of worldly practice" (ibid: 457–458). One reason to take an interest in the BCL pedagogy I will be discussing here is that it is nothing if not such a novel worldly domain. But Pickering's larger point

is not well taken. There are more ways to be worldly than the material construction of cybernetic gizmos. What is the elaboration of cybernetic theories through writing, speaking, conversing, editing, publishing, and teaching if not a "domain of worldly practice" that becomes novel to the extent that the content of the discourse is innovative? Pickering continues:

"The other is that I do not understand it (or have perhaps failed to get some key points). I am reminded of the idea common to early cybernetics that closed loops of neurons might be entailed in memory, and I can see how that works, but I cannot see how reentrant loops connect to any idea of consciousness that I can grasp." (ibid: 458)

"Reentrant loops" is a weak formulation for the discourse of recursive cognition as that comes out in the work of Maturana and von Foerster, through the discourse of reentry in George Spencer-Brown, and in the discourse of autopoiesis in Maturana and Francisco Varela. This is indeed a radical as well as novel set of discourses that has set off all manner of worldly consequences. This essay extends Robert Scott (2011) in the effort to understand better how von Foerster's BCL pedagogy made an important contribution to the emergence of second-order cybernetics. Perhaps more understanding of the historical development of von Foerster's BCL pedagogy can assist as well in conceptual comprehension of second-order cybernetics. At the least, the systems counterculture that the BCL becomes in its final years is indispensable for its cultivation.

### The systems counterculture

By "the systems counterculture," I mean to denote a loosely collegial group of seminal scientific thinkers whose particular developments of cybernetic ideas and practices lead them beyond mainstream doctrines and institutions. The systems counterculture's broad cultural effect has been to detoxify the notion of "system" of its military, industrial, and corporate connotations of command and control and to redeploy it in the pursuit of holistic ideals and ecological values. In the United States, this disparate cybernetic reformation coalesces in the later 1960s and

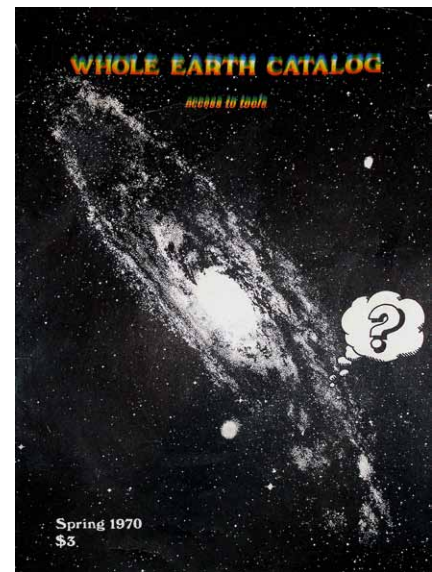


Figure 1: The outside front cover of the Spring 1970 number of the *Whole Earth Catalog* (Brand 1970).

remains well-defined throughout the 1970s. In the first rank of the systems counterculture I place Buckminster Fuller, Gregory Bateson, Heinz von Foerster, Humberto Maturana, Gordon Pask, Francisco Varela, Lynn Margulis, and James Lovelock. In the work of such figures, a broadly shared body of systems theories shuttles between the natural and engineering sciences, and migrates from there to new residences in the social sciences, humanities, and literary and plastic arts. Through multifarious mediations, it infiltrates both high academic theory and popular culture. It enters alternative locations and venues where maverick collaborations become possible and idiosyncratic appropriations can be assembled and tested. Major waves of the systems counterculture are publically registered with the arrival of the first *Whole Earth Catalog* in 1968 and with its periodical continuation, *CoEvolution Quarterly*, in the 1970s (Figure 1).

When the Heuristics courses began, however, the BCL was not quite yet a locus of the systems counterculture. By the time they ended, sixteen months later, it was. In the fall of 1968, the BCL was as yet a mainstream if idiosyncratic scientific research center, well-

funded by military contracts and in a position to venture the Heuristics project as a cybernetic experiment in its own right. This is how von Foerster presents it at the end of 1969 in the preface to the *Whole University Catalogue*: “Initiated by a small group of concerned and curious student[s], Herbert Brün..., and later Dr. Humberto Maturana... joined me in what we all consider to be still a fascinating experiment” (Foerster 1969: 1). A year later, in a program review for the university administration, von Foerster positions the Heuristics courses in relation to the prior work of the BCL as a continuation of research into cognitive problems of learning and teaching. Von Foerster suggests that the recent student uprisings have laid those problems especially bare:

“In anticipation of the urgency to solve these problems this group initiated several years ago a series of inter-disciplinary research programs in cognition (e.g. ‘Theory and Application of Computational Principles in Cognitive Systems’ (1966); ‘Analysis and Synthesis of Cognitive Processes and Systems’ (1968); ‘Cognitive Memory: A Computer Oriented Epistemological Approach to Information Storage and Retrieval’ (1967); etc.) which during these years have harvested a considerable body of knowledge.” (Foerster & Brün 1970: 3)

Von Foerster refers here to a theoretical interest in cognitive problems that had been gathering in his own work for several years prior to the student rebellions in the spring of 1968. One traces these conceptual upheavals in his papers of the later 1960s, as his interest goes increasingly toward the recursive workings of cognitive operations. For instance, in the 1969 paper “What is Memory that It May Have Hindsight and Foresight as Well?” (reprinted in Foerster 2003), von Foerster expresses impatience over superficial evocations of informatics with a critique of storage-and-retrieval metaphors applied to the study of the mental faculty of memory:

“Books, tapes, micro-fiches or other documents that are retrieved... only when looked upon by a human mind, may yield the desired ‘information.’ By confusing *vehicles* for potential information with *information*, one puts the problem of cognition nicely into one’s blind spot of intellectual vision, and the problem conveniently disappears.” (Foerster 2003: 103; see also: 201)

And in an era of pervasive personal and social reexamination, the “problem of cognition” also reads as an indirect expression for constrictions of institutional vision, for instance, misapplications of informatics through narrow-minded mechanistic attitudes in scientific concepts as well as in academic policies.

In an interview with Albert Müller and Karl H. Müller, Humberto Maturana underscores cognition as the central concern of his own BCL research. Asked what he may have contributed to von Foerster’s thinking, he remarks that he

“...came in a moment to the BCL in which my way of facing the questions about cognition in the domain of biology made a difference: introducing the observer as an active participant in the generation of understanding and in the process of explaining the observer. That was my concern: explaining the observer, not merely claiming, the observer is there, but explaining it.” (Maturana 2007: 39)

Maturana goes on to recollect what he took to be a watershed moment in his interactions with von Foerster and the BCL, the crossing of a threshold separating a control-theoretical informational cybernetics from its coming cognitive reformation within second-order cybernetics:

“When I came back in 1968 for a longer time... I put my emphasis on circularity, on the observer participating, on the distinction by an observer... [Von Foerster] was still speaking in those days about information and information in the environment. I remember that during one of my first lectures in Illinois I said: ‘Information does not exist, it is a useless notion in biology... because biological systems do not operate in these terms, it is a useful notion for design for understanding systems that are very well specified, you may describe relations in these terms but living systems do not operate in those terms.’” (Maturana 2007: 45)

The “problem of cognition” brings the “human mind” back into play for a newer cybernetics not content to rely on models of informatic reception drawn from metaphorical extensions of transmission apparatuses, but instead ready to approach a constructivist formulation of cognition. Von Foerster’s cognitive turn reaches full statement and

maximum compression in the final remarks of “Thoughts and Notes on Cognition,” first published in 1970 in tandem with Maturana’s “Neurophysiology of Cognition” (1970). As we will remark later, “Neurophysiology of Cognition” will be reprinted in 1972 as part of the student-produced BCL publication *Metagames*. Addressed directly to the formulation Maturana recalls regarding “information in the environment,” “Thoughts and Notes on Cognition” revokes the ontological credentials of the information concept. Information here is no longer the freestanding transmitted input to a receiving apparatus – a neuron or whatever – but the outcome of self-referential system processes that are cognitive in the first instance:

“5.6 Cognitive processes create descriptions of, that is information, about the environment.  
6 The environment contains no information. The environment is as it is.” (Foerster 1970b: 47)

In other words, in these early stirrings of second-order formulations, information is no longer granted system-external being. Rather, it becomes the system-internal outcome of a self-referential cognitive process, which process may then go on to attribute its construction to its environment. If this reversal of cognitive attitude is somewhat less of a radical gesture in the present moment, nonetheless, it remains a widely disputed repudiation of objectivistic truisms in favor of what we would now call a form of epistemological constructivism. In 1970, it was a non-stop ticket departing the scientific mainstream for the systems counterculture.

## Heuristics as cognitive self-organization

“Heuristics,” the preface to the *Whole University Catalogue*, may be examined for what it reveals in hindsight about the movement of von Foerster’s thinking at this time. Ostensibly, his preface expounds how that concept applies to the design and aims of the Heuristics courses and justifies the open-ended and self-organizing nature of their group pedagogy. But one could also read it as marking the shift from an informatic to a cognitive orientation. “Heuristics” consists largely of a lexical exercise in the closure of

semantic reference, from which a philosophical moral is then drawn. Von Foerster cites two dictionary definitions of *heuristic*, with the observation that both dictionaries “know only of the adjective.” “Heuristic” is defined variously as “helping to discover or learn” and “Designating the educational method in which the student is allowed or encouraged to learn independently through his own investigation.” The Indo-European root of the term is then cross-listed to the dictionary entry for *eureka*, Greek for “I have found (it),” famously attributed to Archimedes. He notes that the American Heritage Dictionary entry for “eureka” then refers the reader once again to the Indo-European root *wer-*. Von Foerster comments:

“With this referral back to *-wer* closure of the lexical search for ‘heuristic’ has been achieved, but left to us is to discover, to find, (to invent?), or to learn the meaning of the words ‘discover,’ ‘find,’ ‘invent’ and ‘learn,’ which all describe those enigmatic processes by which knowledge is acquired.” (Foerster 1969: 1)

Von Foerster excavates from this circular etymological tour a self-referring process by which one learns how to learn. Although the dictionary definitions of *heuristic* are perfectly well-formed clusters of semantic information – strings of linguistic signifiers suitable for coding and transmission to storage media and facilities to await decoding and retrieval – nonetheless, such information, in and of itself, does nothing “until looked upon by a human mind.” The circularity of lexical reference is a mere matter of the linkage of informatic structures. In contrast, the self-referential recursion of cognition – such as that entailed by learning and understanding the meanings not just of words but of the processes they signify – is a complex systemic operation. Von Foerster then invents a noun, “plural in form, used with a singular verb,” to name this complex, the manifold of processes for “The study of the as yet unknown processes by which knowledge is acquired,” *heuristics*. Although the latest online edition of the *Oxford English Dictionary* as of November 2011 lists usages preceding von Foerster’s course as variants of a singular noun, the plural noun is still not listed in its own right. However, the Wikipedia entry in English on *heuristic* indicates that the plural

form *heuristics* is now the more common usage. It may be that von Foerster had a significant hand in popularizing this newer usage. In any event, in good later BCL parlance, the *heuristics* of the *Heuristics* courses would be *the discovery of discovery*.

## The Whole Earth Catalog and the Whole University Catalogue

Von Foerster’s cognitive turns and attention to self-referential closures announce the coming of second-order cybernetics as a deliberately non-informatic systems theory to be aligned with the theory of autopoiesis as directed at nondesigned or natural systems. The BCL is cultivating these epistemologically radical systems theories concurrently with von Foerster’s radical pedagogical experiments (see Müller 2007). They share a late-’60s ambiance, a confrontational attitude against constituted scientific and academic authorities and methods. Concurrently, the BCL comes under what proves to be terminal pressure from the Mansfield Amendment’s destruction of its military funding prospects (Umpleby 2003).

“During the final four years of the BCL, there were only two successful grants that listed von Foerster as the principal investigator: an air force grant in 1970 to support ‘direct access intelligence systems’ and a small non-military grant in 1973 to support von Foerster’s final college course, which produced the book *Cybernetics of Cybernetics* (1974).” (Scott 2011: 1154–1155)

However, the source of the modest civilian grant making the large size and considerable production values of that volume possible is not negligible. It is the Point Foundation, the non-profit organization headed by Stewart Brand, creator and editor of the *Whole Earth Catalog*. Brand set up the Point Foundation to disburse the considerable profits generated by the mass distribution of the *Last Whole Earth Catalog* of 1971 (Turner 2006: 120). Like its BCL predecessor, the *Whole University Catalogue*, *Cybernetics of Cybernetics* is also a deliberate homage to this central document of the systems counterculture. Elsewhere I have described the *Whole Earth Catalog* and its subsequent

publications as “the virtual house organ on the world stage for the popular discussion of the breadth of cybernetic complexities” (Clarke 2009b: 300). In fact, the connection between Brand and von Foerster is highly significant for the further unfolding of second-order cybernetics and for the great post-BCL phase of his career. The May 1974 appearance of *Cybernetics of Cybernetics* coincides closely with the first number of *CoEvolution Quarterly*, the journal Brand began about three years after the *Last Whole Earth Catalog*, to which von Foerster would contribute a handful of items (Clarke 2009b: 300–302). The *Whole Earth Catalog* may have been a product of “U.S. hippie culture” (Müller 2008: 62), but it is now recognized as a considerable cultural phenomenon and historical resource edited with high intelligence and filled with mostly impeccable and invaluable content across a range of scientific, technical, and social topics. (Turner 2006; Kirk 2007; Clarke 2011) Each of its successively larger iterations begins with a section titled “Whole Systems,” centered on but not limited to the work of the systems thinker Buckminster Fuller, inventor of the geodesic dome and peripatetic academic much in vogue in the American counterculture. In *CoEvolution Quarterly*, Gregory Bateson takes over this central role in Stewart Brand’s intellectual universe (Clarke 2011: 267–282).

First published concurrently, as it happened, with the first semester of the *Heuristics* courses, the *Whole Earth Catalog* has cogent treatments of cybernetic pioneers such as Norbert Wiener, Ludwig von Bertalanffy, Ross Ashby, and Warren McCulloch. One year later, in the fall of 1969, the capstone project for the otherwise open-ended activities of the *Heuristics* courses is the creation of a *Whole University Catalogue*. This was neither frivolous nor merely faddish. Von Foerster would have vetted the integrity of the *Whole Earth Catalog* as a source of cybernetic and other high-level intellectual content in the midst of and despite an otherwise radical relation to mainstream American academic as well as social institutions. As von Foerster declares in its preface, the *Whole University Catalogue* is a “tangible result of one class project... stimulated by the superb *Whole Earth Catalogue*” (Foerster 1969: 1). In Spring 1970, it publishes von

Foerster's substantial review of George Spencer-Brown's *Laws of Form* (Foerster 1970a). The *Whole University Catalogue* is

“conceived as a vehicle for expressing ones perceptions of a special world, the Cosmos and the Chaos of our University... Unedited, as the expressions were delivered in words or pictures, they are reproduced here to be contemplated by the onlooker who may see what he can learn from them.” (Foerster 1969: 1).

Like the page count of the *Whole Earth Catalog's* successive editions going from 40 to over 500, over its three semesters enrollment in the Heuristics courses balloons: “The number of students of all ranks and fields who first participated was 23, in Spring [1969] it became 52, and in this semester this number grew to 156” (Foerster 1969: 1). Drawn from students in cross-listed classes in the departments of Electrical Engineering and English, much of the content of the *Whole University Catalogue* is entirely inoffensive and unremarkable, reminiscent here and there of an undergraduate literary magazine or a college yearbook. For instance, page 7 is devoted to “The Overall Oneness of Experience,” with nine photographs of trees accompanied by quotations ranging from Milton to James Dickey, while page 25 intersperses a free-verse poem, “Once a Pawn of Time,” with photographs of university scenes and line drawings in the manner of Peter Max and *Yellow Submarine*. Pages 36–37 offer a “Guide to T. G. I. F. spots” with thumbnail reviews of restaurants and beer joints. And closely modeled on the *Whole Earth Catalog*, pages 60–61 have a handful of short book notices featuring works in the BCL orbit, such as the essay collection *Purposive Systems*, Ross Ashby's *Design for a Brain* and *Introduction to Cybernetics*, and Warren McCulloch's *Embodiments of Mind*.

However, unlike the *Whole Earth Catalog*, which identifies its contributors, and unlike traditional college publications, the point of which is to give out individual creative credits like so many gold stars, no piece or article of the *Whole University Catalogue* is by-lined. Instead, the preface gives the participating students' names en masse over the sole signature of von Foerster. This quasi-communitarian approach may be a sort of late-60s group signature. But the rationale

for it likely goes beyond that. To his signature he appends a note: “I assume full responsibility for the form and all the content of this Catalogue. All inquiries, written or by telephone, about particular projects exhibited in this Catalogue should be addressed to me” (Foerster 1969: 1). Von Foerster is shielding his students' individual identities.

As well he might, for taken as a whole, this *Catalogue* is remarkably funky. One could certainly question the wisdom, if not the spirit, of von Foerster's letting it play out as far as it does. Page 14 gives a photographic account of anti-Vietnam War protest on campus and elsewhere, written from the point of view of striking students and complete with a political cartoon of then-sitting President Richard Nixon hogtied to the rails of an impending Moratorium on War train. Page 30 presents a lengthy sophomoric rant under the title “Fuck the Foreign Language Requirement.” Pages 48–49 provide, suitable for clipping and posting on walls, a centerfold of Margaret Mead advocating before the U.S. Senate for the legalization of marijuana. On page 90 a well-written article titled “Fuck the System” taps the undercurrent of political anger transmuted into absurd theater by the Yippies – the flamboyant acid-fueled, mock-political Youth International Party. “Fuck the System” lauds New York City's infamous Mad Bomber George Matesky in the midst of snippets from Abbie Hoffman's Yipie manifesto *Revolution for the Hell of It* and Jerry Farber's *The Student as Nigger*.

Most damning in the eyes of the university and the Illinois legislature is surely the most concerted and unified sequence in the entire publication, essentially, the climax at the top of its narrative arc – “Drugs and the University or The Whole?” It purports to offer hard documentation of the drug culture on campus along with advice on how to elude the campus and local authorities. Lengthy descriptions of various illegal substances are accompanied by instructions in their use. A frightening image of a homemade set of works for mainlining drugs is set off against schematics for a bricking machine to process harvested pot for transport. Some of its details are outrageous spoofs, such as an inset photograph of a youth stooped over a trash receptacle – like something out of Thomas Pynchon's *The Crying of Lot 49* – with the caption,

“The drug user picks up his dope which is left in pre-arranged pick-up spots on campus.” Similarly laughable is, on the following page, the photograph of a student – his eyes barred as in some 1950s porno mag – with the alarming caption, “The needle aids in injecting cafeteria food with drugs, facilitating the dosing of unsuspecting individuals.” These shocking vignettes are student satires, Yippie theater to freak out any squares who might stumble across them.

But such subtleties are lost upon von Foerster's scandalized administrators when the complaints begin to land on their desks. The following May, Illinois state senator G. William Horsley introduces a resolution that duly creates a special joint committee to investigate “campus disorders.” It is deemed that the *Whole University Catalogue* is such a disorder. On 18 September 1970, von Foerster testifies before the Horsley committee. The next day his campus newspaper covers the hearings with a page of photographs. One is captioned “Legislator inspects excerpts from von Foerster's ‘The Whole University Catalogue.’” In that picture it is open to the article “Fuck the System.” Opposite is a picture of von Foerster seated before a microphone testifying in his students' and his own defense (Daily Illini 1970). A Springfield newspaper covers the hearings under the headline “‘Radical Teachers Present Testimony.’” The portion of the article devoted to von Foerster reads in full:

“Heinz Von Foerster, a physics professor for 21 years at the U. of I., testified concerning a publication which was written and distributed by members of one of his classes.

Included in the publication were such items as how to: Conduct a riot, cheat the telephone company, cheat on rent to the landlord, find Marijuana in Champaign County, make narcotics for yourself, shoot dope, inject drugs into the food supply at a cafeteria and cheat parking meters.

Von Foerster said ‘more good than harm’ comes from the publication. After dickering with committee chairman G. William Horsley, R-Springfield, about his right to speak on the subject before being asked questions, Von Foerster explained the purpose of the class is “to find solutions to problems with constraints. ‘If you want to regulate a system you must understand it,’ he said. ‘Students are concerned with the deep problems of society.’” (Illinois State Register 1970)

The internal Heuristics report (Foerster & Brün 1970), dated 3 October, two weeks after this public testimony, couches research at the BCL in the same terms. It is applied cybernetics, systems theory in search of solutions to social and pedagogical deficiencies.

## From Ecological Source Book to Metagames

It would seem that in the semester immediately following the Heuristics courses and the distribution of the *Whole University Catalogue*, von Foerster momentarily sets aside the experimental flair if not the holistic aims of the systems counterculture. The *Whole Earth Catalog's* models of cybernetic holism found the next major phase of their expression in Bateson's *Steps to an Ecology of Mind*, published in 1972. Von Foerster's course in "Engineering Ecology," conducted in the spring of 1970 without a cross-listed humanities component, was in broad conceptual resonance with such nascent ecophilosophy, but it does not appear to have been a vigorous experimental vehicle. To tell from its mostly sober and earnest student-generated publication, *Ecological Source Book*, his pedagogy retreated for a while from the production of innovative or edgy class projects. That may have been what this particular collection of students wanted for their project and/or what its professor needed at the moment. The preface of the *Ecological Source Book* indicates that while the course proceeded to some degree in open-ended heuristic fashion, it was now more firmly guided by the course's nominal topic and its instructor's holistic motivations. Its approach was "to develop first the conceptual framework in which a totality can be conceived and then to let the search for specifics fall where they appear to be needed" (Foerster 1970c: i). Still, compared to either the *Whole Earth Catalog* or the *Whole University Catalogue*, with a few exceptions the *Ecological Source Book* looks very much like a traditional textbook. Once again, no individual credit is given for its contents. But here this circumstance comes across not as a countercultural gesture but as a pretense of impersonal objectivity. The *Ecological Source Book* does not playfully explode in multiple directions. In an academically proper but



Figure 2: The outside cover of *Metagames*.

plodding fashion, it gathers itself up into an orderly sequence.

However, von Foerster does not abandon his experimental teaching initiatives. His subsequent activities would argue instead that he determines to step all the way into the role of "radical teacher" that has now been scripted for him. His edgy pedagogy pauses only in order to broaden its philosophical base before leaping forward once more into the vanguard, as he throws in his lot with the systems counterculture with a vengeance. Robert Scott (2011: 1153–1154) has summarized the key event here:

“In the summer of 1971, Ivan Illich and Heinz von Foerster arranged a series of meetings at the Center for Intercultural Documentation in Cuernavaca, Mexico with Herbert Brün, Humberto Maturana, Gordon Pask, and students. The discussions reflected Illich's recently published *Deschooling Society*, as well as Brün and von Foerster's reflections on heuristics, Maturana's recently proposed theory of 'autopoiesis,' and Pask's interjections from his nascent 'conversation theory.' The meetings with Illich appear to mark a turning point in von Foerster's thinking about education.”

Austrian émigré Ivan Illich was not a cyberneticist but a charismatic social critic and seminal advocate for radical educational reform. His Mexican retreat center and call for "counterfoil institutions" made him an active sponsor of and major philosopher for the American intellectual counterculture. In the early 1970s he brought systems thinkers into his orbit at CIDOC (see Foerster 1971; Varela 2009: 72). "The seminar in Cuernavaca amplified the shifts in von Foerster's thinking, in his drift away from first-order engineering problems and toward issues of observation itself, looking at language and society" (Scott 2011: 1154).

With the writing of the Mansfield Amendment on the wall, in the last three years of its run, the BCL resolves itself into a virtual counterfoil institution, its research project the design of alternative pedagogies to test second-order cybernetics' forays into cognitive and epistemological issues. The professor of biophysics at its head no longer dabbles but dives headlong into metaphysics, a development or *Nachträglichkeit* of Viennese culture waiting to happen ever since the young von Foerster fell under the spell of Wittgenstein, "Uncle Ludwig" (see Clarke

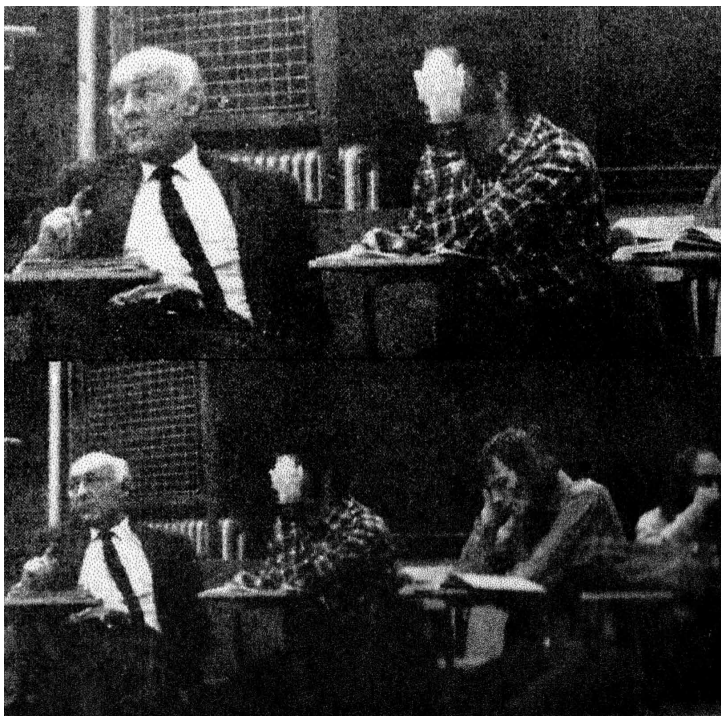


Figure 3: Co-observers.

& Hansen 2009: 27–28). The fruits of these radical reorientations are amply documented in the 1972 student publication of the BCL. It has the explosive playfulness of the *Whole University Catalogue* without its extraneous anarchism, the coherent purposefulness of the *Ecological Source Book* without its needless regimentation. Its entire cover leaps out at its viewer, boldly focused on the eyes of an observer. On the front cover, one eye hovers above a title that declaims the discovery of cognitive possibilities through the observation of play – *Metagames: Games of Psychological, Political, Sociological, and Epistemological Significance*. It brilliantly models the advent of second-order cybernetics’ attention to the observation of observation as a pedagogical device (Figure 2).

Most of *Metagames* consists of the products of classroom projects, a series of increasingly complicated board games approached as playful machines for reality-construction. Altogether, the content of *Metagames* draws out the constructedness of cognition through meta-tactics based on the staging of co-observers (Figure 3). It gives

the explicit theorization of this approach to “the observer” in its reprint of Maturana’s “Neurophysiology of Cognition”:

“For the observer an entity is an entity (a unit of interactions) when he can describe it. To describe is to enumerate the actual or potential interactions and relations of the described entity. Accordingly, the observer can describe an entity only if there is at least one other entity from which he can distinguish it and with which he can observe it to interact or relate, even if this is the observer himself, and which serves as a reference for the description.” (Maturana 1970: 4; reprinted in Foerster 1972: 29)

Unlike its predecessors’ openings, which state only the professor’s overview, the inside front cover of *Metagames* introduces multiple observations of the course that produced it. Over and against von Foerster’s usual signature and statement stand the signature and copyright claim of an individual student spokesperson, Steven Sloan, who describes and documents a classroom technique of co-observation: “This class endeavored not

only to concentrate on what was said but also the observable processes by which the content was generated. Scribes took notes on the content and meta-scribes took notes on the accompanying interpersonal interactions.” In sample portions alongside Sloan’s statement, a scribe observes exterior classroom events, while a metascribe observes its own and others’ observational moods and attitudes regarding the “object matter” of the same events:

“ Scribe  
After a few remarks by the Chairman, Sandy proposed the creation of ‘game box’ as the class project, since most of the groups seemed to have an interest in this general area. HVF then announced his coming trip to Europe, and explained the timetable that was passed out to the class...

Metascribe  
Almost forgot to start writing. Chairman mumbled a few notes about the directories he handed out, then led into Sandy Baron’s presentation on creating a ‘box’ of ‘goodies’ at the end of the semester. Many possibilities. New room. Very old-fashioned and comfortable, in 218 Ceramics Engineering Building. The class is quiet and relaxed. Sandy turns the floor over to Heinz.” (cited on the inside front cover of Foerster 1972)

The text of the metascribe is lengthier because the inclusion of self-observation renders its discourse more complex. The meta-point of this second-order game, of course, is that the “objective” account of the scribe is no more, the “subjective” account of the metascribe no less, “true” than the other. The outcome of this exercise is to suspend the entire notion of an objectively true account by embedding any account in a feedback loop of accounts upon accounts. The recursion of observation opens up a play space for the unfolding of creative conversations.

The first page is titled “What game is reality?” This implicit preface expounds the universal metaphor of the play space of *Metagames*:

“Now, what game is reality? First, there must be at least two players who want to play it. They create a large board with lots of objects on it which they agree to call ‘The World.’ Then they put themselves on this board and invent a set of rules for the objects. These rules they agree to call ‘The

Laws of Nature.' If, during the game, it turns out that the rules they applied in creating the objects don't jibe with the rules they invented to play with the objects, they either ignore these objects or change 'The Laws of Nature.'"<sup>9</sup>

In other words, *Metagames* is a metaphor for as well as a meta-observation upon the doing of science. Von Foerster signs "What game is reality?" not with a by-line but with an image of "the gentleman in the bowler hat," the well-known figure, drawn by Gordon Pask, that first shows up in 1960 in "Self-Organizing Systems and their Environments" (Foerster 2003: 1–19; see Clarke 2009a: 43–46). What appeared in that essay to be a parenthetical side remark – "it may be interesting to note that reality appears as a consistent reference frame for at least two observers" (Foerster 2003: 4) – has now become, as the passage just cited from "Neurophysiology of Cognition" confirms, a canonical proposition in the emergence of second-order cybernetics. Likewise, the gentleman with the bowler hat makes return appearances – here and a year later in "On Constructing a Reality" – as von Foerster's abiding icon for the co-construction of reality out of a conversation among mutually enclosed consciousnesses (see Müller 2008; Clarke 2009a: 51–58). In this role it pops up throughout *Metagames* to provide visual continuity.

However, the primary content of *Metagames* is made to be scissored into bits – board games along with their game pieces, scorecards, tokens, and other ludic paraphernalia. To leave no unoccupied space on its pages, the obverse sides of the game boards and pieces are decorated with assorted Wittgenstein quotations and what appear to be Rorschach blots. I will leave it to other commentators to retrieve those games and characterize their play. However, as we have already noted, interspersed with this is scholarly content from the BCL research shop. This is the first time that professorial content has entered one of the student-produced magazines from von Foerster's courses. In this way *Metagames* sets the stage for the full-fledged scholarly documentation project to be enacted two years later by *Cybernetics of Cybernetics*. Here such content provides conceptual scaffoldings for the cognitive exploration of game play as a species

of epistemological communication. It consists of four scholarly articles: in addition to the reprint of Maturana's "Neurophysiology of Cognition," there is an untitled reprint of a Gordon Pask essay on self-organization in technological and social systems, to which the documentation appends the title "My Prediction for 1984" and the date 1962; running upside down with reverse pagination beside the Maturana article is Herbert Brün's "Technology and the Composer"; and at the end of the magazine, its closing statement, is von Foerster's "Perception of the Future and the Future of Perception."

I will touch briefly on two more sections of *Metagames*. After the last of the board game content, page 83 duplicates the image of the eye on the cover, framed now to form a kind of asymmetrical vessel surrounded by

a fascinating text whose title would appear (from its bold font) to be "self-reference" (Figure 4). Once again, there is no by-line for this lay-out, so one can only speculate whether von Foerster himself is the author or just the instigator of this set of plays upon the paradoxes of self-reference. I will assume that he is indeed its author. Perhaps this too is a metagame to indicate the meta-dialectical character of second-order conceptual formations. On one side of the eye of the observer is a series of negations, either lexical or propositional. On the other side is a contrasting series of positive statements or phrases. What one can now observe in comparing them is that negativity is self-correcting, whereas positivity is self-amplifying. But this is much more than a first-order cybernetic lesson in feedback mechanisms.

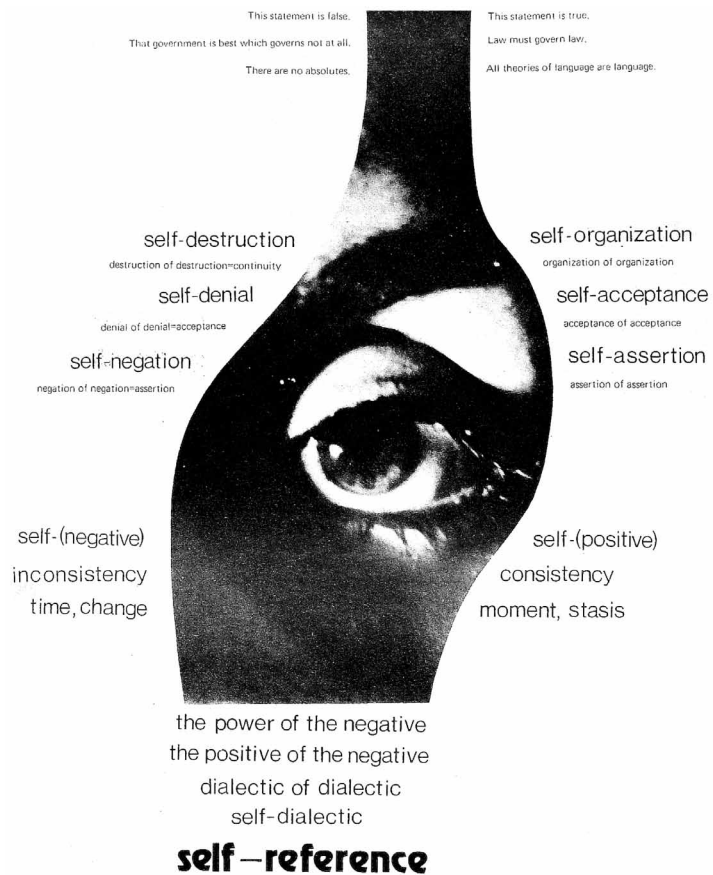


Figure 4: Visual association of "self-reference" in *Metagames*.





Figure 5: The photography of photography 1.

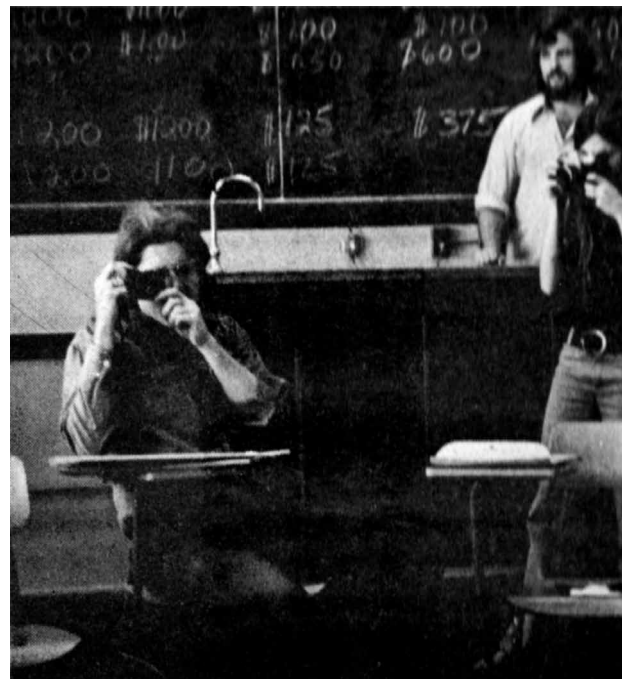


Figure 6: The photography of photography 2.

For instance, take the three paradoxical propositions on the top left of the figure:

“This statement is false.  
That government is best which governs not at all.  
There are no absolutes.”

In each case, when referred back to themselves, these propositions correct their own overstatements by suggesting their positive counterparts. “This statement is false” performs the very truth of its own falsity: “This statement is true.” “That government is best which governs not at all” performs its own nullification, just as its positive counterpart properly posits the self-referential nature of the concept of legality: “Law must govern law.” “There are no absolutes” unfolds a positive form of its own absolutism: “All theories of language are language.” The introduction of the *self*-function – so long interdicted and occluded by the blind spot of the Enlightenment – allows aberration to work itself out, to get itself back on a positive course. “Self-destruction” unfolded as the “destruction of destruction” yields “continuity,” “self-denial”

unfolded yields “acceptance,” and “self-negation” unfolded yields “assertion.” And having come so far, “self-assertion” compounds itself in the “assertion of assertion.” In the self-correcting dynamics demonstrated on this page of *Metagames*, von Foerster turns Hegel’s implicitly paradoxical “power of the negative” into the explicitly paradoxical “positive of the negative.” The self-acknowledgment of paradox makes all the difference. It seems to me that this page encapsulates the abiding promise of second-order cybernetics to inspire the overcoming of epistemological impasses. The neocybernetic guidance of such second-order metaphysics joins directly to the wider aspirations of the systems counterculture as a scientific mode of spiritual reformation.

Immediately following this quite magical page of *Metagames* is the self-reference of the publication’s composite brain trust. Pages 84–85 present a portfolio of photographs from the classroom where Electrical Engineering 272 and 490 and Biophysics 491 have been combined. A suite of photographs sweeps across the airy high-ceilinged room,

showing its bright windows and its professor mingling amidst an animated throng of students. A few details from this page capture the gist of the co-observational methods and meta-dynamics going on. A series of student photographs show students taking photographs. A young woman is first the object of another’s photograph and then, at the same time, photographed taking a photograph of her photographer (Figure 5). Down again goes the subject/object distinction. Adjacent to that image is another depiction of the observation of observation, a shot of one photographer being photographed by a second photographer (Figure 6). Adjacent to that is a shot of the same two photographers, revealing now that the first is taking a picture of von Foerster. The next page shows von Foerster in dialogue with Pask at the blackboard, with Maturana smiling from a student desk chair (Figure 7). Beneath that, two stationary photographs assemble the class on opposite sides of the room (Figure 8). Finally, two last photographs: empty seats, then an empty floor, like the multiple bows and then exit of a cast at the end of a play.

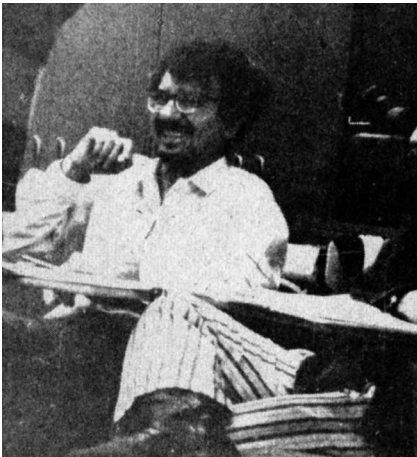


Figure 7: Maturana in a student desk chair.



Figure 8: The class.

## Conclusion

To restate the key philosophical issue I have ventured to extract from these playfully oblique materials: behind the dialectical power of the negative as codified in Hegel's preface to *The Phenomenology of Mind*, there is the more basic power and productivity of the paradoxical. Rather than discard his insights into the "positive of the negative," von Foerster seeks the means to learn from and teach them. Although it got him into hot water, such a conviction regarding the positive of the negative may have been one rationale for his refusal to censor what others deemed to be the objectionable content of the *Whole University Catalogue*. Welcoming the positivity of paradox must have been, in a sense, a phase in his conversion to constructivism, for which, in the end, the previous mainstream career of the BCL had to be sacrificed.

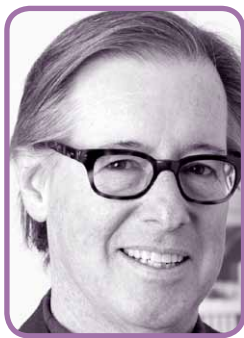
The play of paradox teaches that, just as all observation is self-referential in the first instance, all things are self-positing within their own "domain of interactions." And to that extent, there is no negativity except that which we construct through the power of language to produce negative constructions. For when pressed back upon their own premises, negations will negate

themselves and bring the one that posits them back, not to where they started precisely, but to an enhanced view on the positivity of what may be constructed. Just as the environment contains no information, either positive or negative, nature knows no negation. We may agree with Spinoza that "all determination is negation," but nonetheless, the environment contains no determination. Such information-creating distinctions are self-wrought upon the flux of some observer's description. In the metagame of reality, the world is the game board and its objects are tokens for (eigen) behaviors – that is, for the recursive co-constructions of co-observing systems and their environments.

Viewed against the prehistory I have told in this article, *Cybernetics of Cybernetics*, the student mega-publication subvented by the Point Foundation and published in the spring of 1974, appears as the comprehensive final compendium of the cybernetic contexts and collegial co-productions of the BCL. It seems likely that von Foerster already knew he was bringing his organized research operation to a close. *Cybernetics of Cybernetics* marks the formal initiation of second-order cybernetics as an all-out mobilization of the power of paradox and of its gentle handmaiden, self-reference.

It marks the sublation or transcending of Norbert Wiener's cybernetics of communication and control through "the control of control and the communication of communication." It remedies the blindness of the supposed objectivity of the cybernetics of observed systems with the observation of observation, the participation of observation in the construction of its own objects.

Collectively bootstrapped from his last university course, this final student volume would indicate that von Foerster was a successful student of his own continuing course on heuristics. Over the previous six years, he has learned how to discover, to invent, and to teach the second cybernetics that lay implicit but unrecognized behind the first cybernetics. It is a comprehensive shift from a communicational and computational informatics to a new cognitive ecology of biological, dialogical, and sociological processes. This is not the informatic process of self-organization from noise he celebrates a decade earlier (Foerster 2003: 11–14). It is self-complexification from a heuristic dialogue self-applied to his own scientific and professional life. What he can do now, more so than before, and what he will do for the rest of his intellectual career, is to make explicit the difference that second-order cybernetics makes.



## BRUCE CLARKE

is Paul Whitfield Horn Professor of Literature and Science in the Department of English at Texas Tech University. His research focuses on 19th- and 20th-century literature and science, with special interests in systems theory and narrative theory. He edits the book series *Meaning Systems*, published by Fordham University Press. In 2010–11 he was Senior Fellow at the International Research Institute for Cultural Technologies and Media Philosophy, Bauhaus-University Weimar. His publications include *Energy Forms: Allegory and Science in the Era of Classical Thermodynamics* (2001), *Posthuman Metamorphosis: Narrative and Systems* (2008), and the edited collections *Emergence and Embodiment: New Essays in Second-Order Systems Theory* (2009), and the *Routledge Companion to Literature and Science* (2010).

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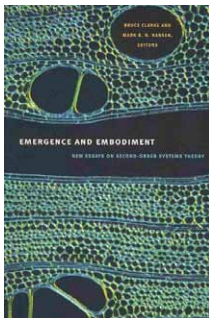
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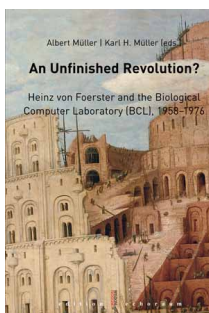
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The book *Emergence and Embodiment: New Essays on Second-Order Systems Theory* edited by Bruce Clarke and Mark Hanson is a collection of essays on second-order cybernetics that draws together ideas related to self-organization, autopoiesis, organizational closure, self-reference, and neurophenomenology. For an extended review see Peter Cariani's "On the Importance of Being Emergent" in *Constructivist Foundations* 5(2): 86–91, available at <http://www.univie.ac.at/constructivism/journal/5/2/086.cariani> Duke University Press, Durham, 2009. ISBN 978-0-6223-4600-5. 296 pages.



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